



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/569,548  | 02/27/2006  | Kenzo Machashi       | 12480000162US       | 7724             |
| 30/593 7590 09/08/2010<br>HARNESS, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 8910<br>RESTON, VA 20195 |             |                      |                     |                  |
| EXAMINER  |             |                      |                     |                  |
| WONG, EDNA  |             |                      |                     |                  |
| ART UNIT  |             | PAPER NUMBER         |                     |                  |
| 1795  |             |                      |                     |                  |
| MAIL DATE   |             | DELIVERY MODE        |                     |                  |
| 09/08/2010  |             | PAPER                |                     |                  |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/569,548

**Applicant(s)**

MAEHASHI ET AL.

**Examiner**

EDNA WONG

**Art Unit**

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 August 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,3-8,11,13,14,17 and 18 is/are pending in the application.
- 4a) Of the above claim(s) 7 and 8 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3-6,11,13,14 and 16-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ ~~Notice of Informal Patent Application~~
- 6) ☐ Other: \_\_\_\_\_

This is in response to the Amendment dated August 2, 2010. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office Action.

### ***Response to Arguments***

#### **Election/Restrictions**

This application contains claims **7 and 8** drawn to an invention nonelected without traverse in the reply filed on May 7, 2009. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

#### **Claim Rejections - 35 USC § 103**

Claims **1-6 and 9-18** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Bokova et al.** ("Laser-Induced Effects in Raman Spectra of Single-Wall Carbon Nanotubes", Quantum Electronics (July 31, 2003), Vol. 33, No. 7, pp. 645-650) in view of **Irle et al.** ("Theoretical Study of Structure and Raman Spectra for Models of Carbon Nanotubes in Their Pristine and Oxidized Forms", *J. Phys. Chem. A* (2002), Vol. 106, pp. 11973-11980).

With regards to claims **2, 9-10, 12 and 15**, the rejection under 35 U.S.C. 103(a) as being unpatentable over Bokova et al. in view of Irle et al. has been withdrawn in view of Applicants' amendment. Claims 2, 9-10, 12 and 15 have been cancelled.

With regards to claims **1, 3-6, 11, 13-14 and 16-18**, the rejection under 35 U.S.C. 103(a) as being unpatentable over Bokova et al. in view of Irle et al. is as applied in the Office Action dated May 13, 2010 and incorporated herein. The rejection has been maintained for the following reasons:

Applicants state that based on the figure captions of FIGS. 1-3 and the associated descriptions in Irle, it is clear that the "oxidizing annealing" merely adds oxygen atoms to the carbon nanotube and is not a process that oxidizes and removes the carbon nanotube. Stated more clearly, the oxidized carbon nanotube is not removed by the "oxidizing annealing." Therefore, the combination of Bokova and Irle does not disclose the selective oxidation and removal of the carbon nanotube by laser irradiation.

In response, present claim 1, lines 6-11, recite:

"irradiating the mixture of nano-scale low-dimensional quantum structures of differing densities of states with the electromagnetic wave in air for two hours after measuring the first Raman spectrum, the electromagnetic wave having an energy density of 10 kW/cm<sup>2</sup> **so as to selectively oxidize and remove a low-dimensional quantum structure of a density of states resonating with the wavelength of the electromagnetic wave**".

In method claims, the intended result is not given patentable weight when it simply expresses the intended result of a process step positively recited (MPEP § 2111.04).

Bokova teaches using radiation from a cw laser at 488.0 nm (2.54eV), 495.5 nm (2.50 eV), and 514.5 nm (2.41 eV) both to act on the material (in air) and to excite Raman scattering (page 646, "2. Experimental"). The spectra were recorded at different 514.5 nm excitation power densities. In the first spectrum excited at a power density of

10 KWcm<sup>-2</sup>, the 187 cm<sup>-1</sup> breathing mode dominates, which corresponds to nanotubes of diameter 1.32 nm (page 648, left column, lines 40-44).

When Applicants claim a process in terms of a function, property or characteristic and the process of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, Applicants should point out the manufacturing process act recited in the claims that would be expected to impart the distinctive structural characteristic to the final product.

Furthermore, the Applicants have a different reason for, or advantage resulting from doing what the prior art relied upon has suggested, it is noted that it is well settled that this is not demonstrative of nonobviousness. *In re Kronig* 190 USPQ 425, 428 (CCPA 1976); *In re Linter* 173 USPQ 560 (CCPA 1972); the prior art motivation or advantage may be different than that of Applicants while still supporting a conclusion of obviousness. *In re Wiseman* 201 USPQ 658 (CCPA 1979); *Ex parte Obiaya* 227 USPQ 58 (Bd. of App. 1985) [MPEP § 2144].

Applicants state that the method disclosed in Bokova is a method for oxidizing the carbon nanotube regardless of the wavelength of the irradiated electromagnetic wave, and is a method that is completely different in principle to the method according to claim 1 of the present application.

Applicants state that in the method of Bokova, the oxidation of the carbon nanotube is dependent only on the laser power or the sample temperature. Therefore,

Bokova shows a phenomenon that occurs independent to the wavelength of the laser.

In response, the claims as presently written recite "a wavelength of an electromagnetic wave". This reads on a wavelength of 488.0 nm, 495.5 nm or 514.5 nm as disclosed by Bokova. Wouldn't each of these wavelengths lead to the selective resonant excitation and/or oxidation of the nanotubes?

Applicants state that irradiation of light (having an energy density of  $10 \text{ kW/cm}^2$ ) in air is illustrated in FIG. 6 of Bokova. However, FIG. 6 of Bokova only illustrates that a Raman spectrum is measured by such irradiation and does not illustrate that the carbon nanotubes are oxidized and removed by irradiating the light having the energy density of  $10 \text{ kW/cm}^2$ . Additionally, the Raman spectrum of FIG. 6 of Bokova is merely for the purpose of showing the physical properties of the sample. Stated more clearly, the measurement was carried out under conditions in which no change is caused to the physical property to the sample being measured.

Applicants state that Bokova neither discloses nor suggests selectively oxidizing and removing a low-dimensional, quantum structure of a specific density of state from a mixture of low-dimensional quantum structures of densities of states "resonating with the wavelength" of the irradiated electromagnetic wave, by irradiating the low-dimensional quantum structure with the electromagnetic wave having an energy density of  $10 \text{ kW/cm}^2$  for two hours.

In response, Bokova teaches using radiation from a cw laser at 488.0 nm

(2.54 eV), 495.5 nm (2.50 eV), and 514.5 nm (2.41 eV) both to act on the material (in air) and to excite Raman scattering (page 646, "2. Experimental"). The spectra were recorded at different 514.5 nm excitation power densities. In the first spectrum excited at a power density of 10 KWcm<sup>-2</sup>, the 187 cm<sup>-1</sup> breathing mode dominates, which corresponds to nanotubes of diameter 1.32 nm (page 648, left column, lines 40-44).

Bokova teaches a similar method as presently claimed. Similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

Applicants state that while Irlé discloses confirming that a carbon nanotube changes its frequency of vibration due to the oxidation, there is no disclosure or suggestion as to the selective oxidation and removal of only the low-dimensional quantum structures having a specific density of state.

In response, there is no requirement that the function, property or characteristic of the presently claimed method be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). The test for combining references is what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. *In re McLaughlin* 170 USPQ 209 (CCPA 1971); *In re*

*Rosselet* 146 USPQ 183 (CCPA 1960). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

Applicants state that based on the teachings of Bokova and Irlé (individually or in combination), it would not have been obvious for a person ordinarily skilled in the art to confirm, by measuring the Raman spectrum, whether only a low-dimensional quantum structure having a specific density of state has been selectively oxidized and removed.

In response, Bokova teaches the irreversible disappearance of the 'breathing' Raman mode of small-diameter nanotubes (0.8-1 nm) and the reversible appearance of additional 'breathing' modes from nanotubes with diameters 0.1-0.3 nm smaller than the diameters of nanotubes undergoing resonance Raman excitation at room temperature (page 645, abstract).

Wouldn't the Raman spectrum have to show other (low-dimensional) quantum structures having specific density of states in order to show that the desired low-dimensional quantum structure having a specific density of state has been selectively oxidized and removed?

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).



A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDNA WONG whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edna Wong/  
Primary Examiner  
Art Unit 1795

EW  
September 3, 2010